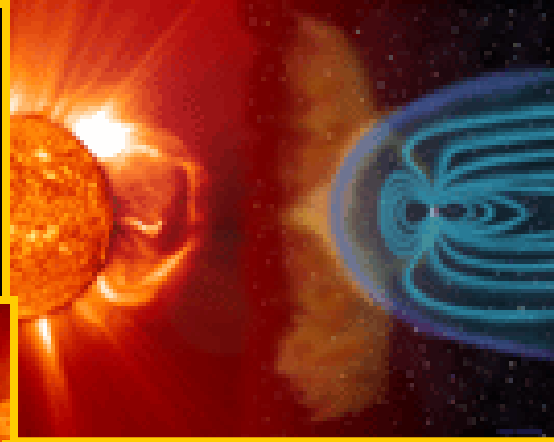

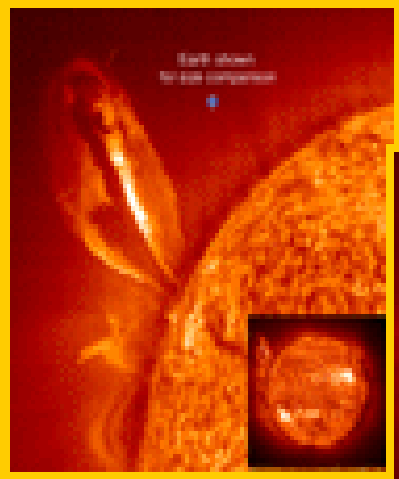

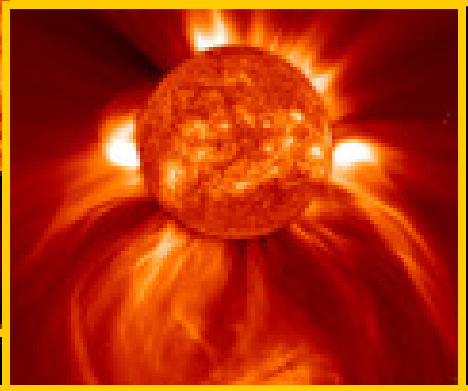

SOHO HGA Keyhole Periods Special Study

Gene Burke & David Morris

July 17, 2003

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California Institute of Technology

SOHO HGA Keyhole Periods Special Study

AGENDA

- BACKGROUND
- STUDY OBJECTIVES
- STUDY ASSUMPTIONS
- HGA KEYHOLE PERIODS
- DSN IMPACT ANALYSES
- SUMMARY
- FUTURE HGA KEYHOLE PLANNING
- QUESTIONS REGARDING HGA KEYHOLE

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SOHO HGA Keyhole Periods Special Study

BACKGROUND

- The SOHO Spacecraft Problem Created a Condition Which is Expected to Occur Every Three (3) Months
- These Conditions Have Been Labeled HGA Keyhole Periods
- HGA Keyhole Periods Range from 15 to 25 Days in Duration.
- 34BWG1 Antenna Are Required for Support During Selected HGA Times
- 70m Antenna is Required for D/L Support During Selected HGA Times
- Simultaneous Use of 26m or 34BWG1 for U/L is Required During 70m D/L

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SOHO HGA Keyhole Periods Special Study

STUDY OBJECTIVES

- **To Perform a Loading Assessment of the DSN 70m and 34BWG1 (S-Band Capability) During the HGA Keyhole Periods.**

- **To Identify Other Projects/Users Significant and Critical Events and Planned Major Antenna Downtimes that Will Affect the Network Loading for the HGA Keyhole Periods Indicated.**

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STUDY ASSUMPTIONS

- 6 Degree Elevation Mask 70m Viewperiod Will be Used for the HGA Keyhole Periods
- Viewperiods Generated from the SOHO Viewperiod File 20030417 Located on the FDF Server
- 34BWG1 Will be Used Except for the HGA Keyhole "Deepest Portion"
- SOHO Viewperiod from FDF
- Simultaneous Use of 26m or 34BWG1 for U/L is Required During 70m D/L

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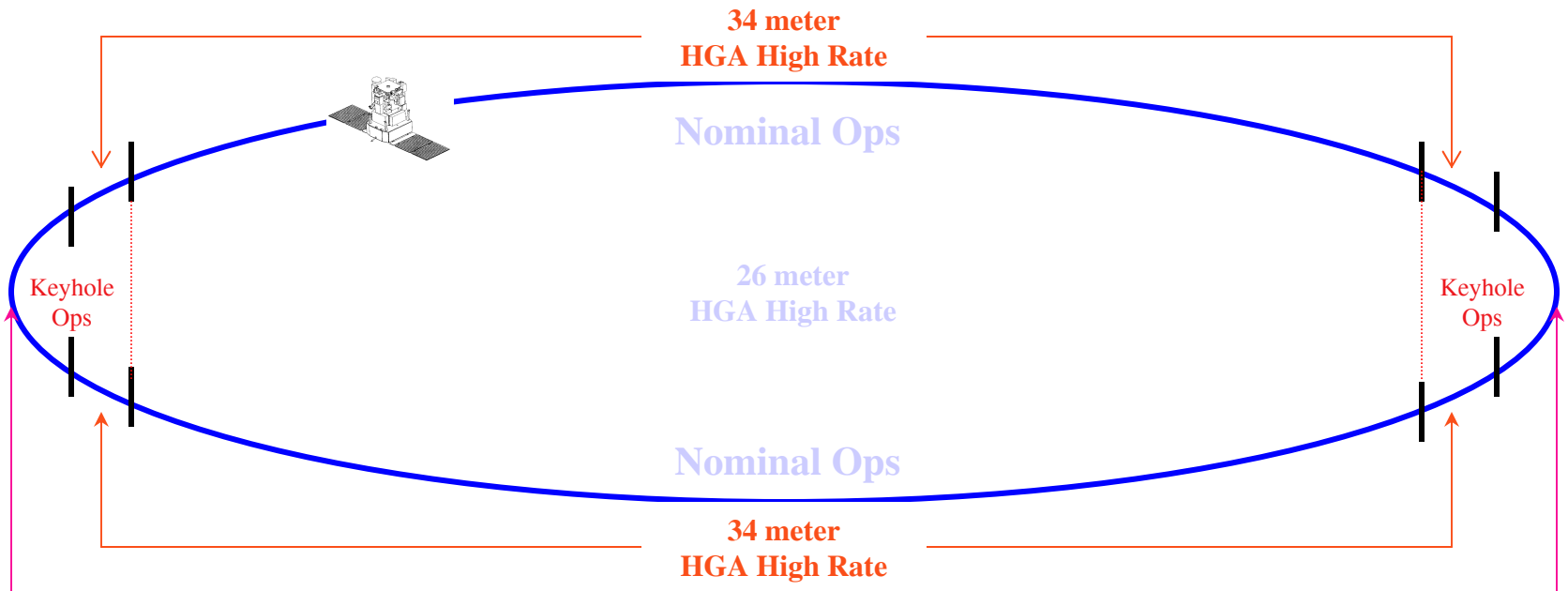
SOHO HGA Keyhole Periods Special Study

SOHO Science Operations*

Orbit @ L1



34 meter
Omni
Medium Rate

OR

70 meter
Omni
High Rate

*Conceptual

SOHO HGA Keyhole Periods Special Study

HGA KEYHOLE PERIODS

1. **27 June 2003 through 14 July 2003 -**

   - This Period has been Resolved in Real-time

2. **22 September 2003 through 16 October 2003**

   a. **HGA: 22 September - 26 September - 34BWG1 or 70m D/L**

   b. **LGA: 27 September - 11 October – 70m D/L High Rate or 34BWG1 Medium Rate**

   c. **HGA: 12 October - 16 October - 34BWG1 or 70m D/L**

   Note: 70m D/L Support Requires Simultaneous 26m or 34BWG1 for U/L

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SOHO HGA Keyhole Periods Special Study

HGA KEYHOLE PERIODS

3. **23 December 2003 through 08 January 2004**
   - a. HGA: 23 December - 25 December - 34BWG1 or 70m D/L
   - b. LGA: 26 December - 04 January – 70m D/L High Rate or 34BWG1 Med. Rate
   - c. HGA: 05 January - 08 January - 34BWG1 or 70m D/L

4. **14 March 2004 through 07 April 2004**
   - a. HGA: 14 March - 19 March - 34BWG1 or 70m D/L
   - b. LGA: 20 March - 02 April – 70m D/L or 34BWG1 Medium Rate
   - c. HGA: 03 April - 07 April - 34BWG1 or 70m D/L

Note: 70m D/L Support Requires Simultaneous 26m or 34BWG1 for U/L

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SOHO HGA Keyhole Periods Special Study

DSN IMPACT Analyses

- **Period 1 -- 27 June – 14 July 2003**
  - This Period has been Resolved in Real-time and is Not Included in this Study.

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SOHO HGA Keyhole Periods Special Study

DSN IMPACT Analyses

- **Period 2 -- 22 September – 16 October 2003**
  - **This Period is Presently Being Negotiated by Project Schedulers**
  - **70m Analyses**
    - **Favorable Viewperiod Overlap with Mars and Other Prime Projects/Users Except DSS Maintenance**
  - **34BWG1 Analyses**
    - **Viewperiod Overlap is Moderate to Extreme with 34BWG1 Projects/Users: Chandra, DSS Maint, Genesis, SIRTF, Ulysses, and Voyager 2**
  - **SOHO Projected Unsupportable Time is Considered Low (<15%)**
  - **SOHO Scheduler Liaison, C. Abramo and Prime Scheduler, T. Kelly, Indicate that Proposals Have Been Generated for this HGA Keyhole Period**
  - **All Issues Should Be Resolved During the RAPSO Negotiation Meetings**

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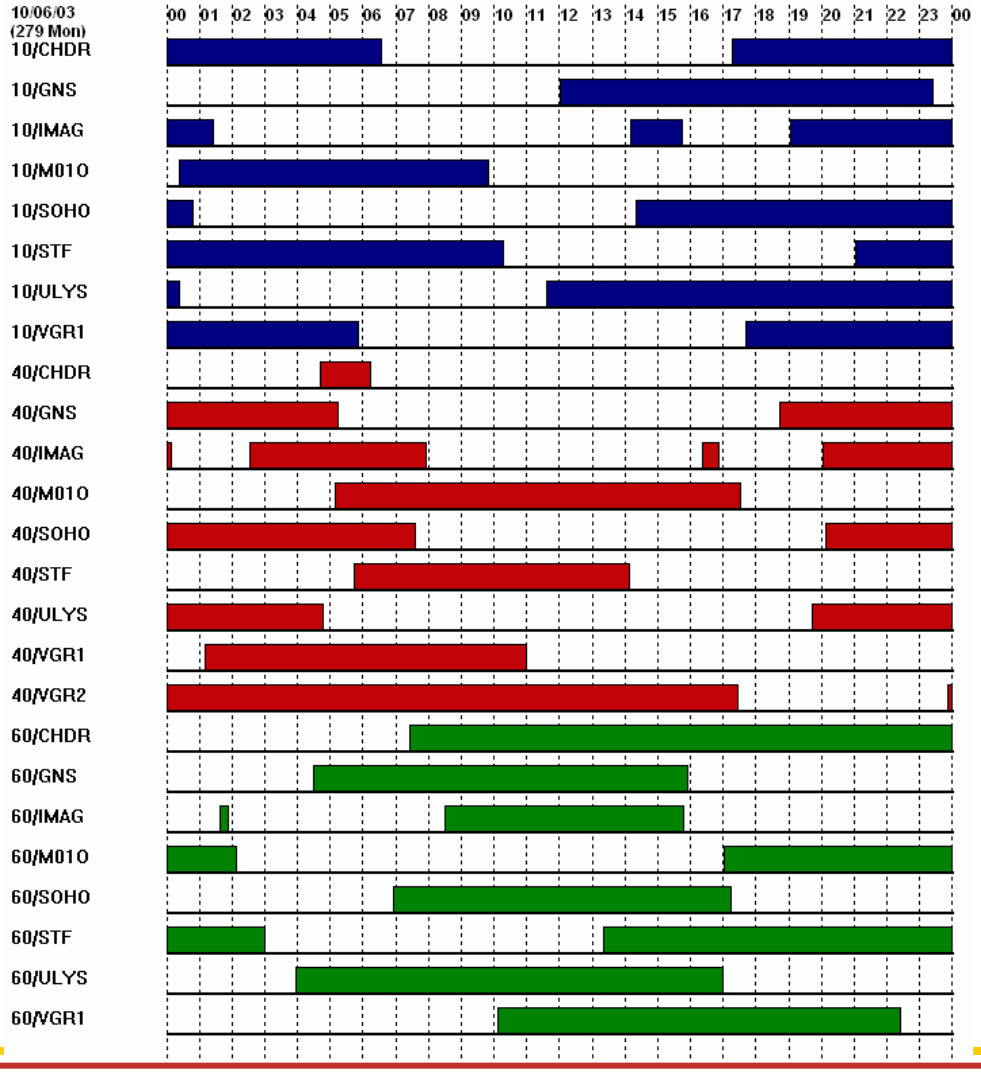
SOHO HGA Keyhole Periods Special Study

Viewperiods

Monday October 6, 2003
(DOY 279 Week 41)

- Chandra
- Genesis
- Image
- Mars Odyssey
- SOHO
- SIRTF
- Ulysses
- Voyager 1
- Voyager 2

SOHO HGA Keyhole Periods Special Study



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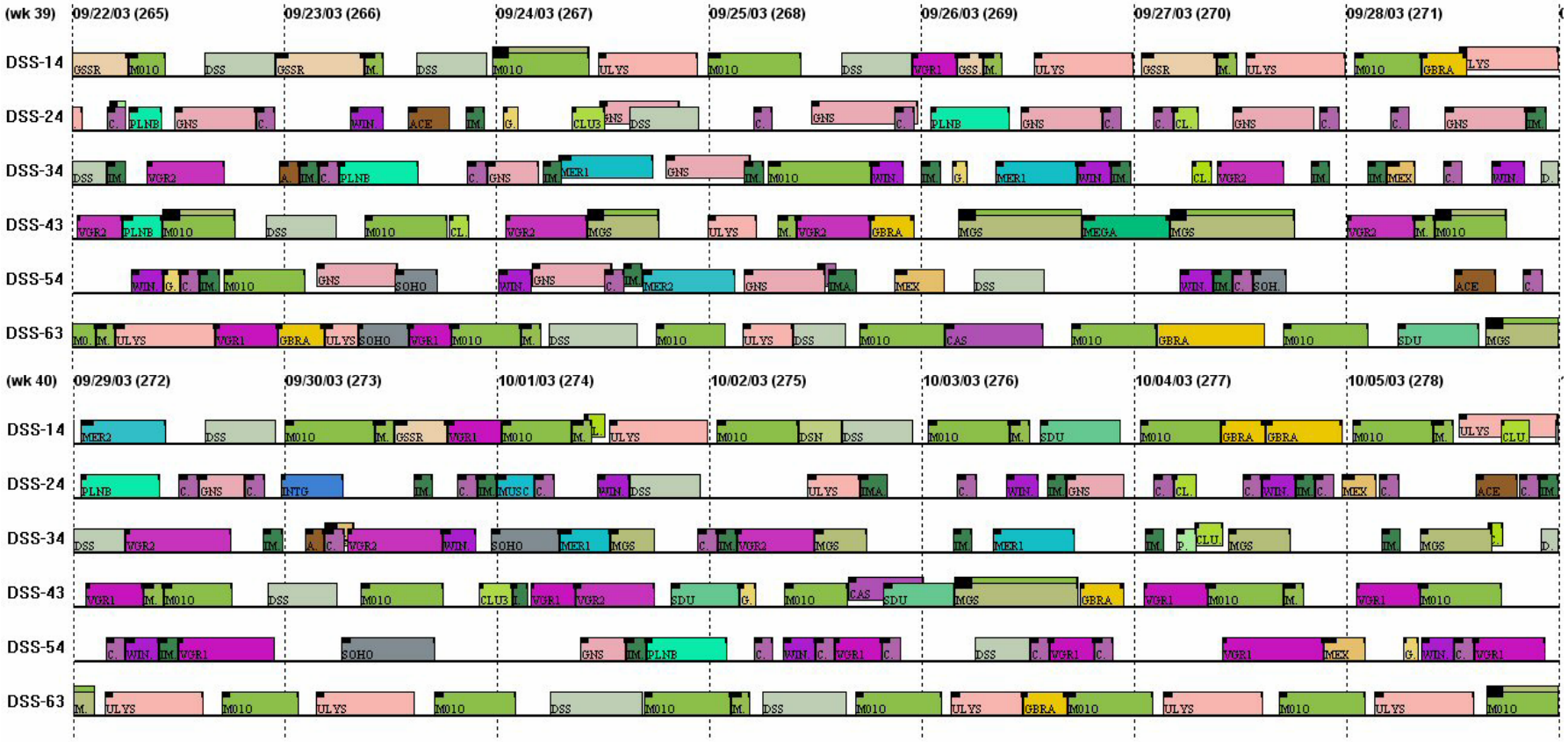
SOHO HGA Keyhole Periods Special Study
Mid-Range Planning Schedule

Weeks 39 and 40
September 22, – October 5, 2003



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SOHO HGA Keyhole Periods Special Study

DSN IMPACT Analyses

- **Period 3 -- 23 December 2003 – 08 January 2004**
  - **70m Analyses**
    - **Unfavorable Viewperiod Overlap with Prime 70m Projects/Users: DSS Maintenance, Mars Projects (45%), and Stardust (80%)**
    - **Stardust Encounter Support is Planned for 20 December 2003 – 13 January 2004**
    - **Stardust has 33 Supports Planned for the P/Wild 2 Comet Encounter**
    - **SOHO 70m Projected Unsupportable Time is considered extreme (>75%)**
  - **34BWG1 Analyses**
    - **Viewperiod Overlap is moderate to extreme with 34BWG1 Projects/Users: Chandra, DSS Maint, Genesis, SIRTF, Ulysses, and Voyager 2**
    - **SOHO 34BWG1 Projected Unsupportable Time is Considered Low NIB to the Mars Projects**

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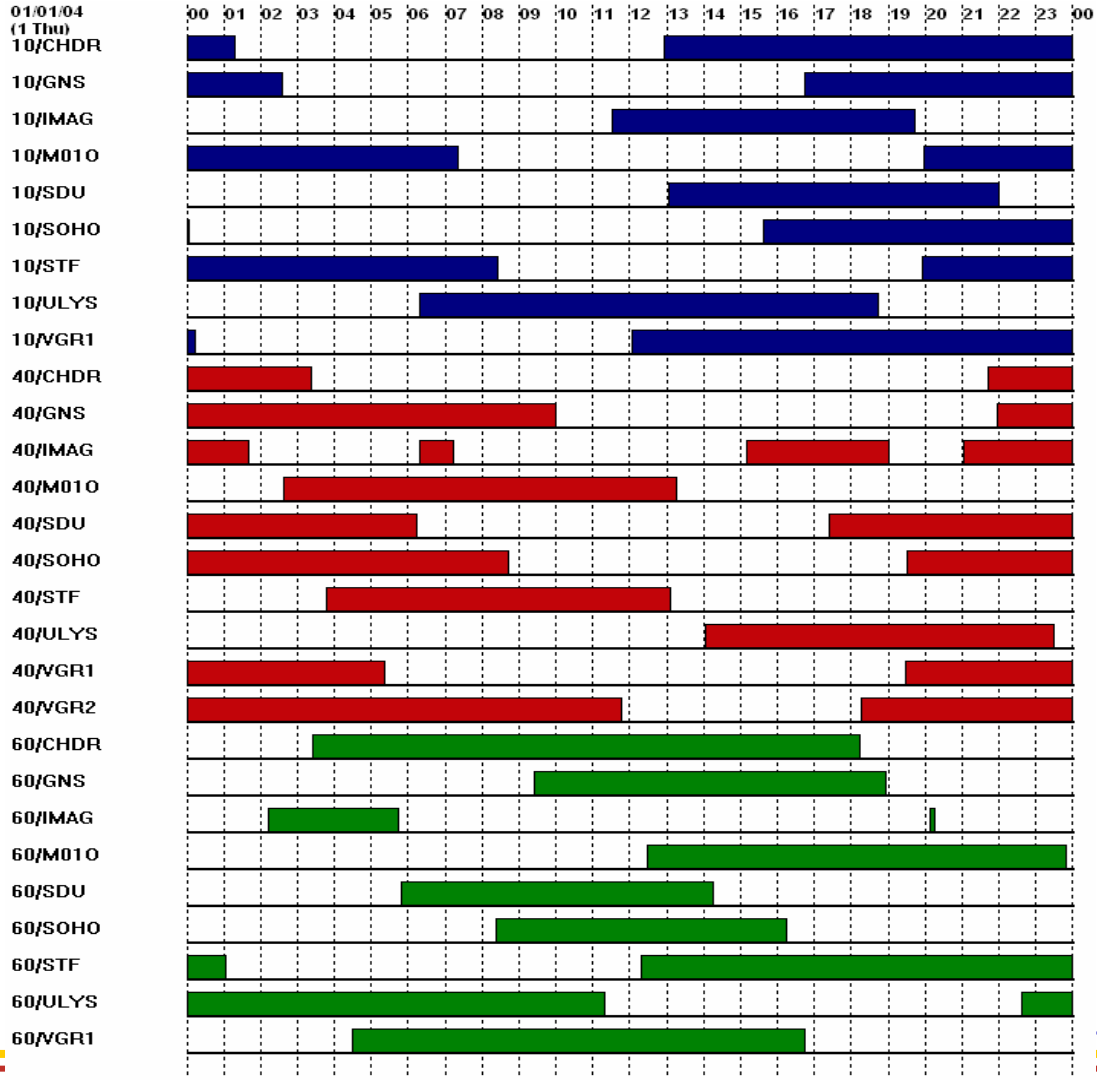
SOHO HGA Keyhole Periods Special Study

Viewperiods

Thursday January 1, 2004
(DOY 001 Week 01)

- Chandra
- Genesis
- Image
- Mars Odyssey
- SOHO
- SIRTF
- Stardust
- Ulysses
- Voyager 1
- Voyager 2

SOHO HGA Keyhole Periods Special Study



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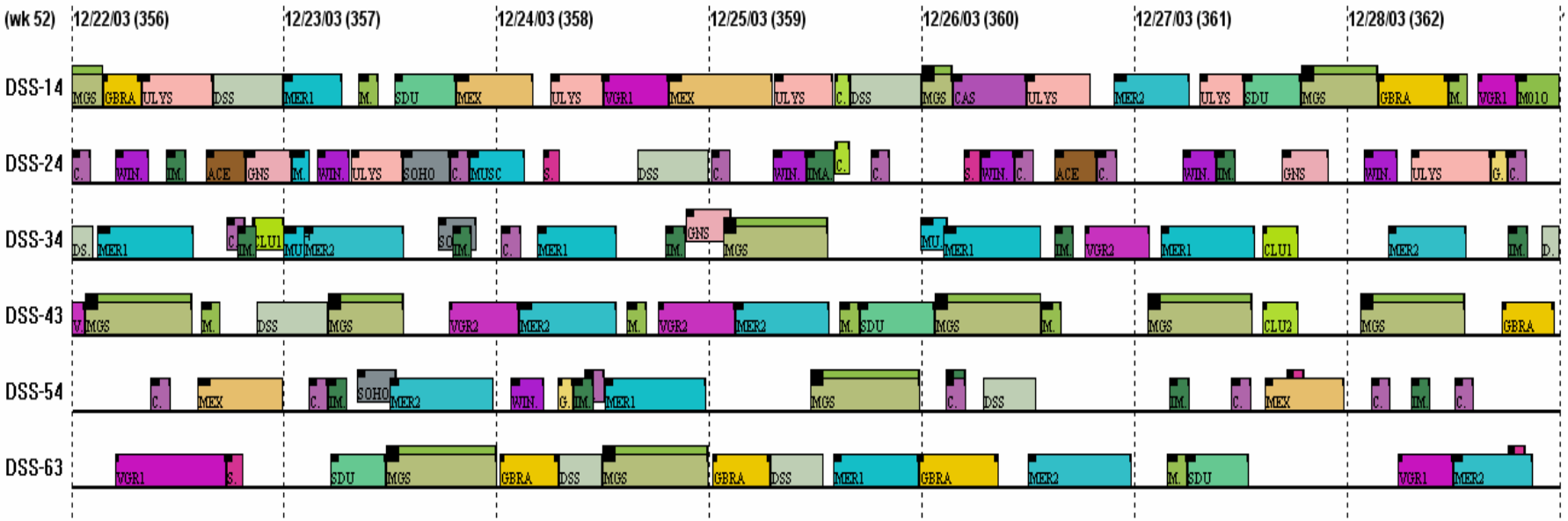
SOHO HGA Keyhole Periods Special Study

Mid-Range Planning Schedule

Week 52

December 22 – 28, 2003



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SOHO HGA Keyhole Periods Special Study

DSN IMPACT Analyses

- **Period 4 -- 14 March – 07 April 2004**
  - **70m Analyses**
    - **Unfavorable Viewperiod Overlap with the Mars Projects (>70%) plus DSS Maintenance**
    - **SOHO 70m Projected Unsupportable Time is Considered High (>75%)**
  - **34BWG1 Analyses**
    - **Unfavorable Viewperiod Overlap with the Mars Projects (>70) plus DSS Maintenance**
    - **Moderate to Extreme Viewperiod Overlap with Other Projects/Users:**
      Chandra, DSS-Maint, Genesis, SIRTF, Voyager 1 and Voyager 2
    - **SOHO 34BWG1 Projected Unsupportable Time is Considered High (>75%)**

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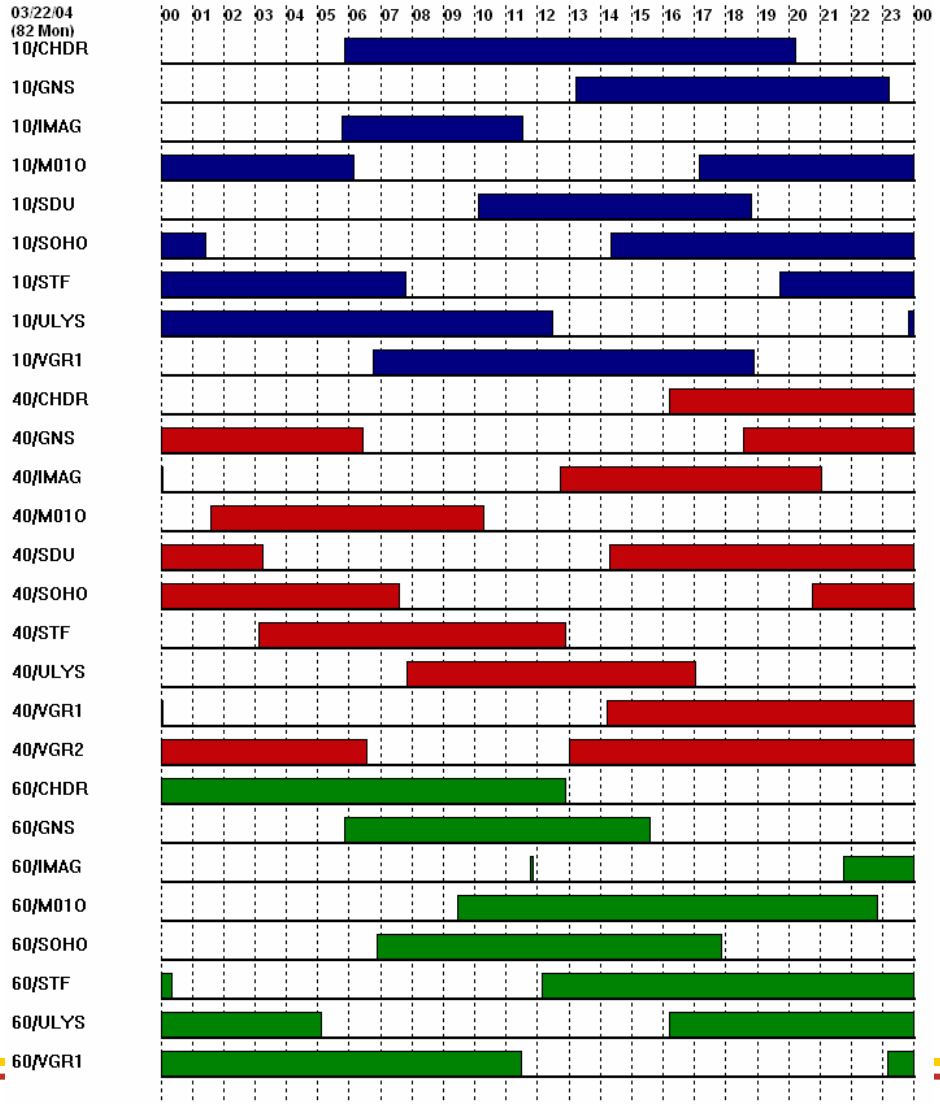
SOHO HGA Keyhole Periods Special Study

Viewperiods

Monday March 22, 2004
(DOY 082 Week13)

- Chandra
- Genesis
- Image
- Mars Odyssey
- SOHO
- SIRTF
- Ulysses
- Voyager 1
- Voyager 2

SOHO HGA Keyhole Periods Special Study



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SOHO HGA Keyhole Periods Special Study

SUMMARY

- **Period 1 – 27 June 2003 through 14 July 2003**
  - **This HGA Keyhole Period has been resolved in Real-time.**

- **Period 2 – 22 September 2003 through 16 October 2003**
  - **SOHO Should Have Little Difficulties in Generating Feasible Proposals for 70m and 34BWG1 Supports**

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SOHO HGA Keyhole Periods Special Study

SUMMARY

- **Period 3 – 23 December 2003 through 08 January 2004**
  - **SOHO 34BWG1 Projected Unsupportable Time is Considered low NIB to the Mars Projects**

HOWEVER

  - **SOHO Will Have Difficulties in Obtaining Ample 70m Supports due to Extreme Viewperiod Overlap with Stardust P/Wild Comet Encounter Supports**

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SOHO HGA Keyhole Periods Special Study

SUMMARY

- **Period 4 – 14 March 2004 through 07 April 2004**
  - **SOHO Will Have Difficulties in Obtaining Ample 70m Supports Due to Extreme Viewperiod Overlap with DSS Maintenance and the Mars Projects Conducting Surface Operations**
  - **SOHO will Have Difficulties in Obtaining Ample 34BWG1 Supports Due to Extreme Viewperiod Overlap with DSS Maintenance and the Mars Projects Support Surface Operations**
  - **SOHO is Projected to Receive:**
    - **2 – 3 Hours 6 of 7 Days at DSS-43 NIB to the Mars Supports**
    - **2 – 3 Hours 4 of 7 Days at DSS-14 NIB to the Mars Supports**
    - **2 – 3 Hours 7 of 7 Days at the 34BWG1 NIB to the Mars Support**

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SOHO HGA Keyhole Periods Special Study

FUTURE PLANNING FOR HGA KEYHOLES

- **The JPL Resource Allocation Planning (RAP) Process was Established to Plan and Forecast DSN Antenna Resources**

- **Long Range Plan**
  - **Identifies Periods of High Contention**
  - **Covers a Period from One to Ten Years in the Future**

- **Resource Allocation Review Board (RARB)**
  - **The Review Board, Consisting of Project Managers and Project Scientist, Make Decisions Regarding Monthly High Contention or Assigns Actions Items**
  - **Covers a Period of Three Years in the Future**
  - **Conducts Meetings the 2nd Tuesday in February and August**

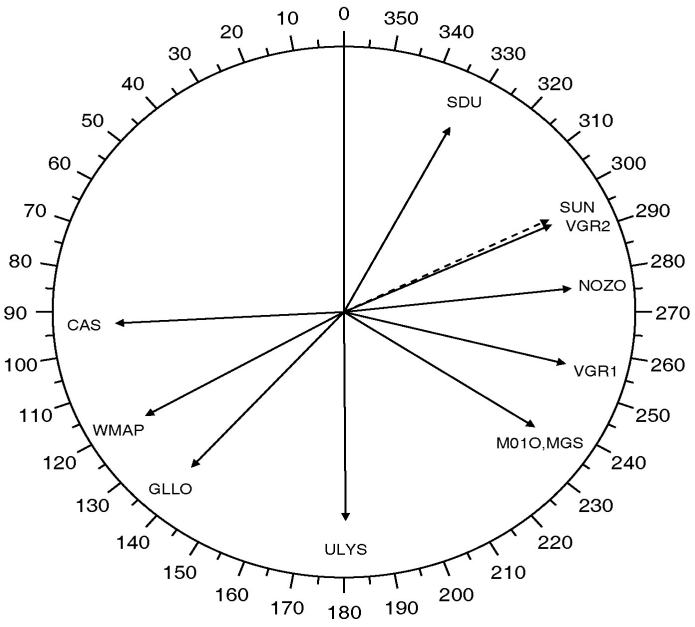
SOHO HGA Keyhole Periods Special Study

FUTURE PLANNING FOR HGA KEYHOLES

- **Joint Users Resource Allocation Planning Committee (JURAP)**
  - **JURAP Meetings Acts as an Interim Resource Allocation Review**
  - **Projects/Users Representative Presents Future Plans**
  - **Meetings are Held the Third Thursday of Each Month**

- **Mid-Range Allocation Plan**
  - **Detailed Support Requirements including Special Activities and Accurate DSN Viewperiods Are Provided to RAP by each Project**
  - **Identifies and Resolves all Facility Conflicts**
  - **Covers a Period from 8 Weeks to 6 Months in the Future**
  - **Transfers a CONFLICT-FREE Four-Week Plan to DSN Scheduling Monthly**

SPACECRAFT RIGHT ASCENSION
JANUARY 15, 2003

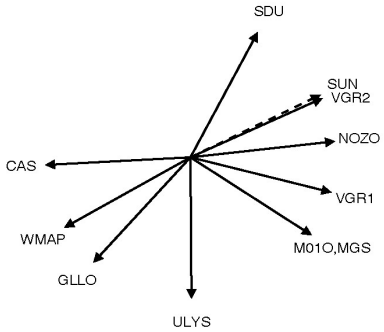


THE SPACECRAFT RIGHT ASCENSION FIGURES SHOW THE POSITIONS OF THE SPACECRAFT IN THE SKY RELATIVE TO EACH OTHER ON THE 15TH OF EACH MONTH FOR THE YEAR INDICATED. RIGHT ASCENSTION IS COMMONLY MEASURED IN HOURS, WITH 1 HOUR = 15 DEGREES.

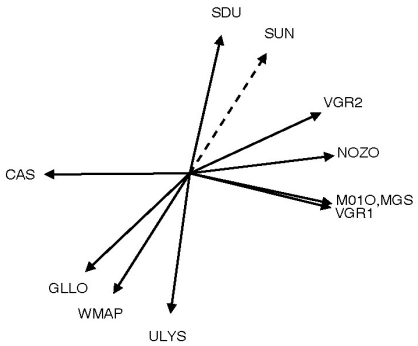
THE ARROW INDICATES THE CENTER OF A SPACECRAFT VIEW FROM EARTH. EXTEND 60 DEGREES ON BOTH SIDES OF THE ARROW TO CALCULATE AN EIGHT (8) HOUR VIEW PERIOD.

SPACECRAFT RIGHT ASCENSION
2003

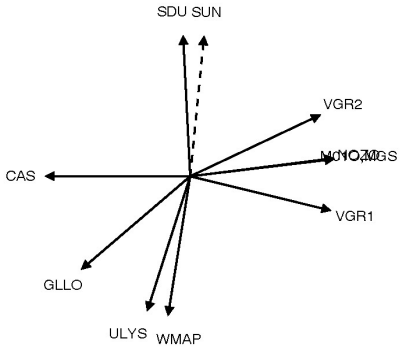
January



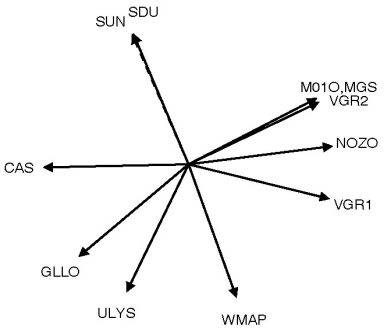
February



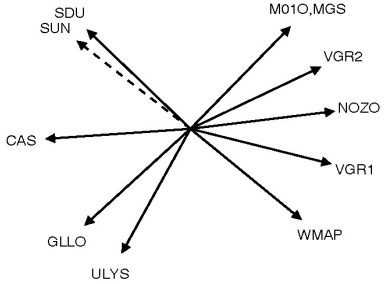
March



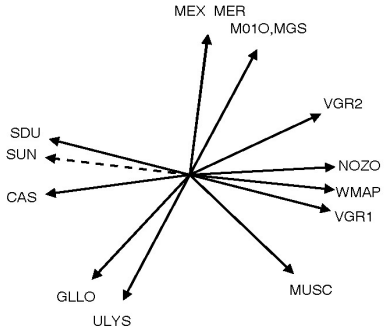
April



May



June



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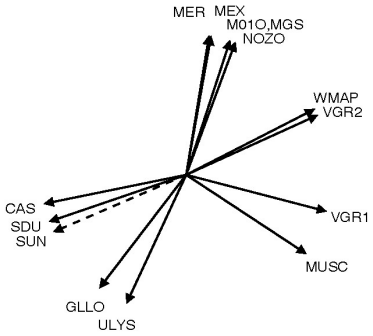
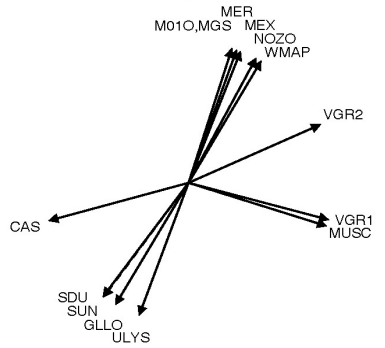
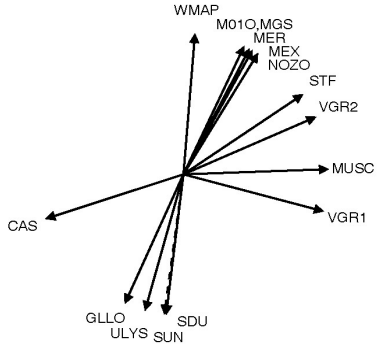


August



September



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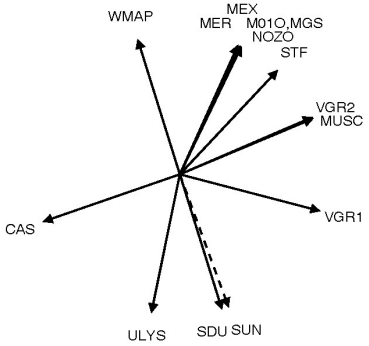
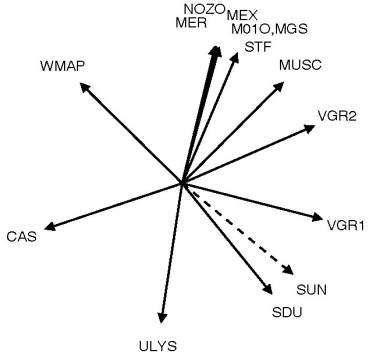
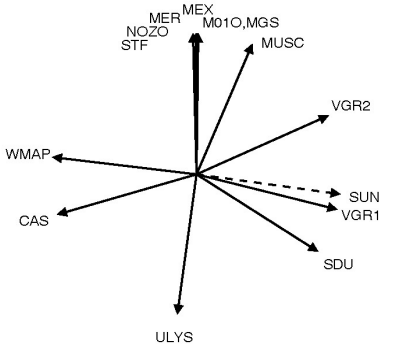


November

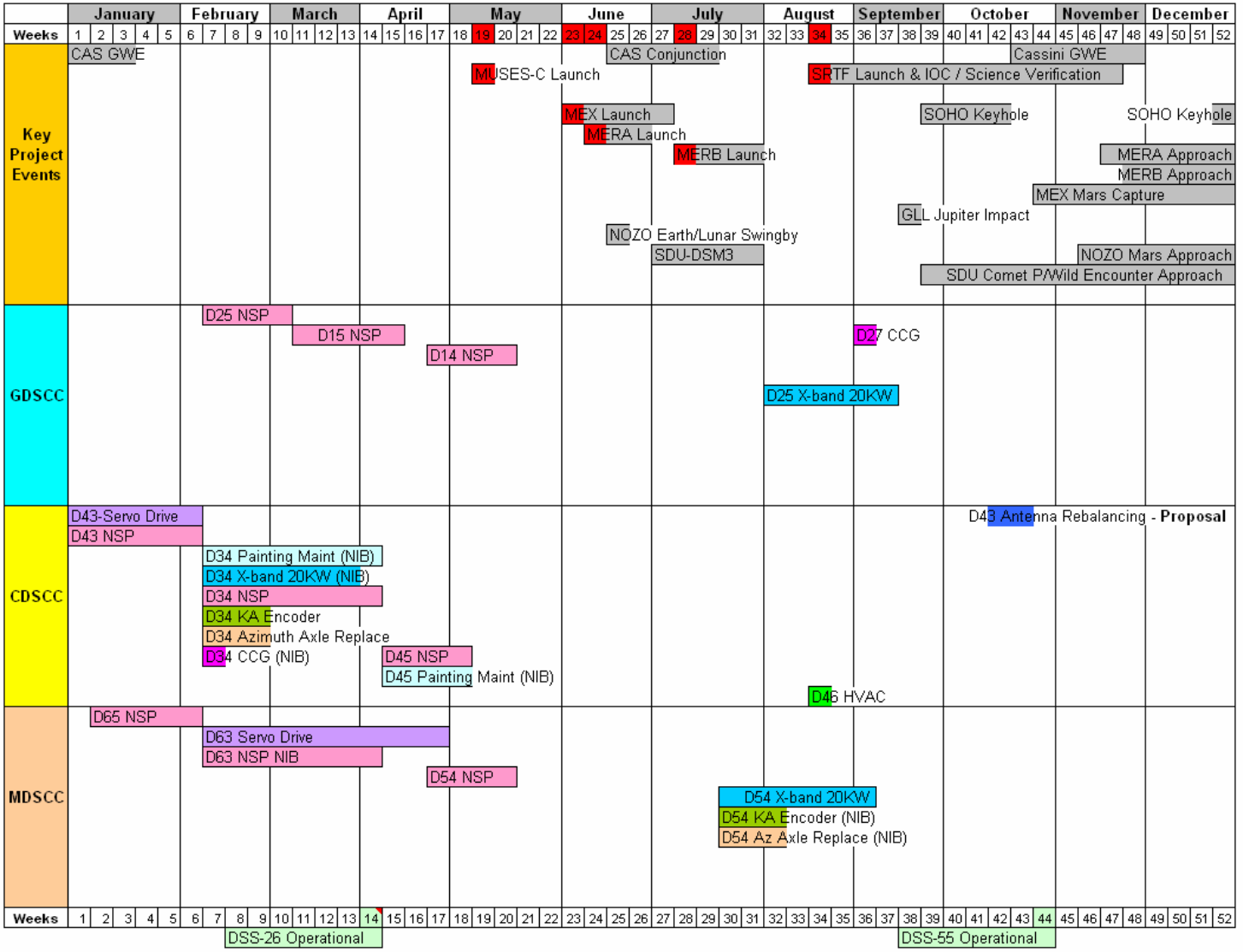


December



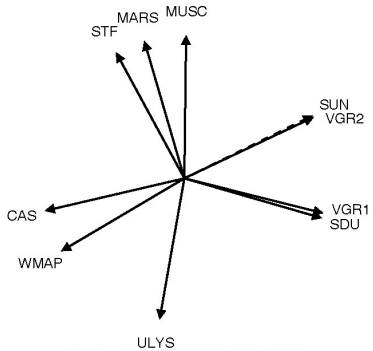
SOHO HGA Keyhole Periods

2003



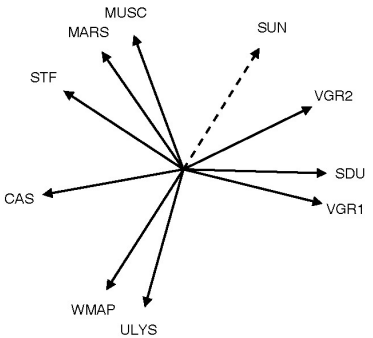
SPACECRAFT RIGHT ASCENSION
2004

January



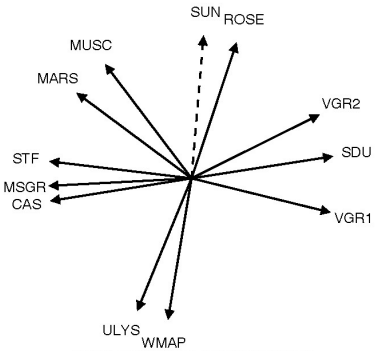
MARS=M01O,MER,MEX,MGS,NOZO

February



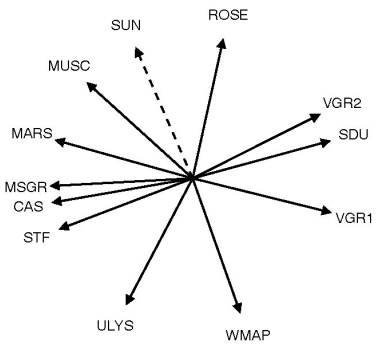
MARS=M01O,MER,MEX,MGS,NOZO

March



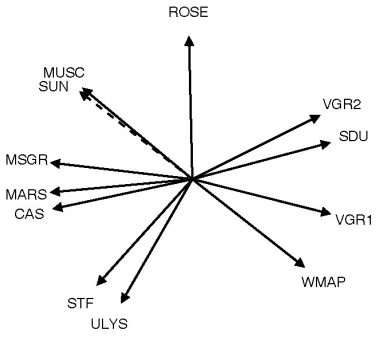
MARS=M01O,MER,MEX,MGS,NOZO

April



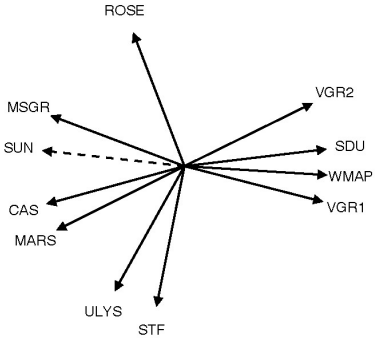
MARS=M01O,MER,MEX,MGS,NOZO

May



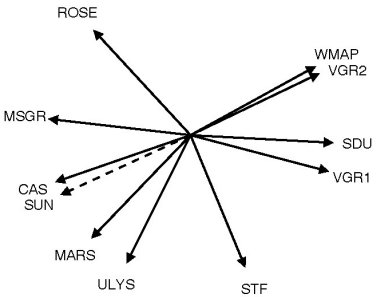
MARS=M01O,MER,MEX,MGS,NOZO

June



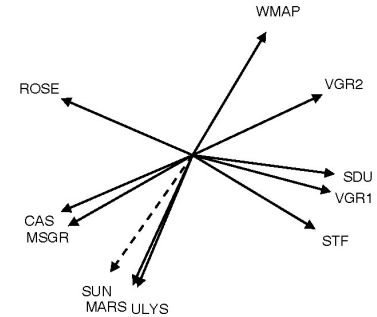
MARS=M01O,MER,MEX,MGS,NOZO

July



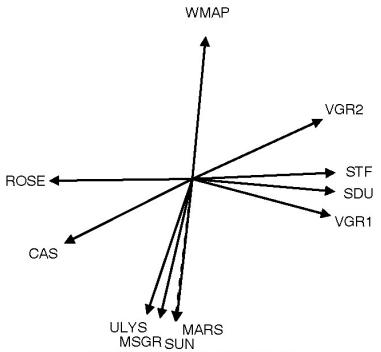
MARS=M01O,MEX,MGS,NOZO

August



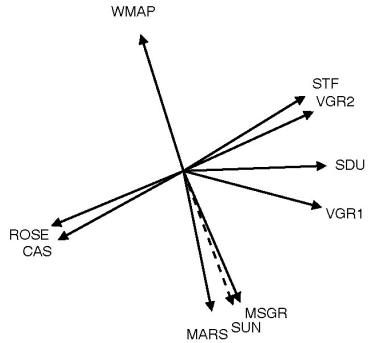
MARS=M01O,MEX,MGS,NOZO

September



MARS=M01O,MEX,MGS,NOZO

October



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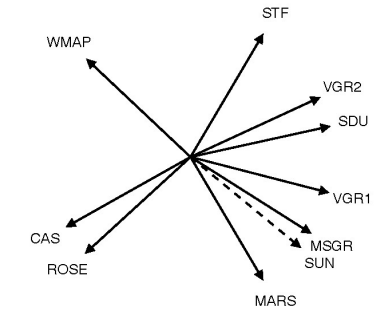
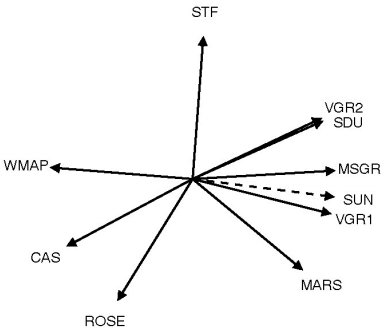
November



MARS=M01O,MEX,MGS,NOZO

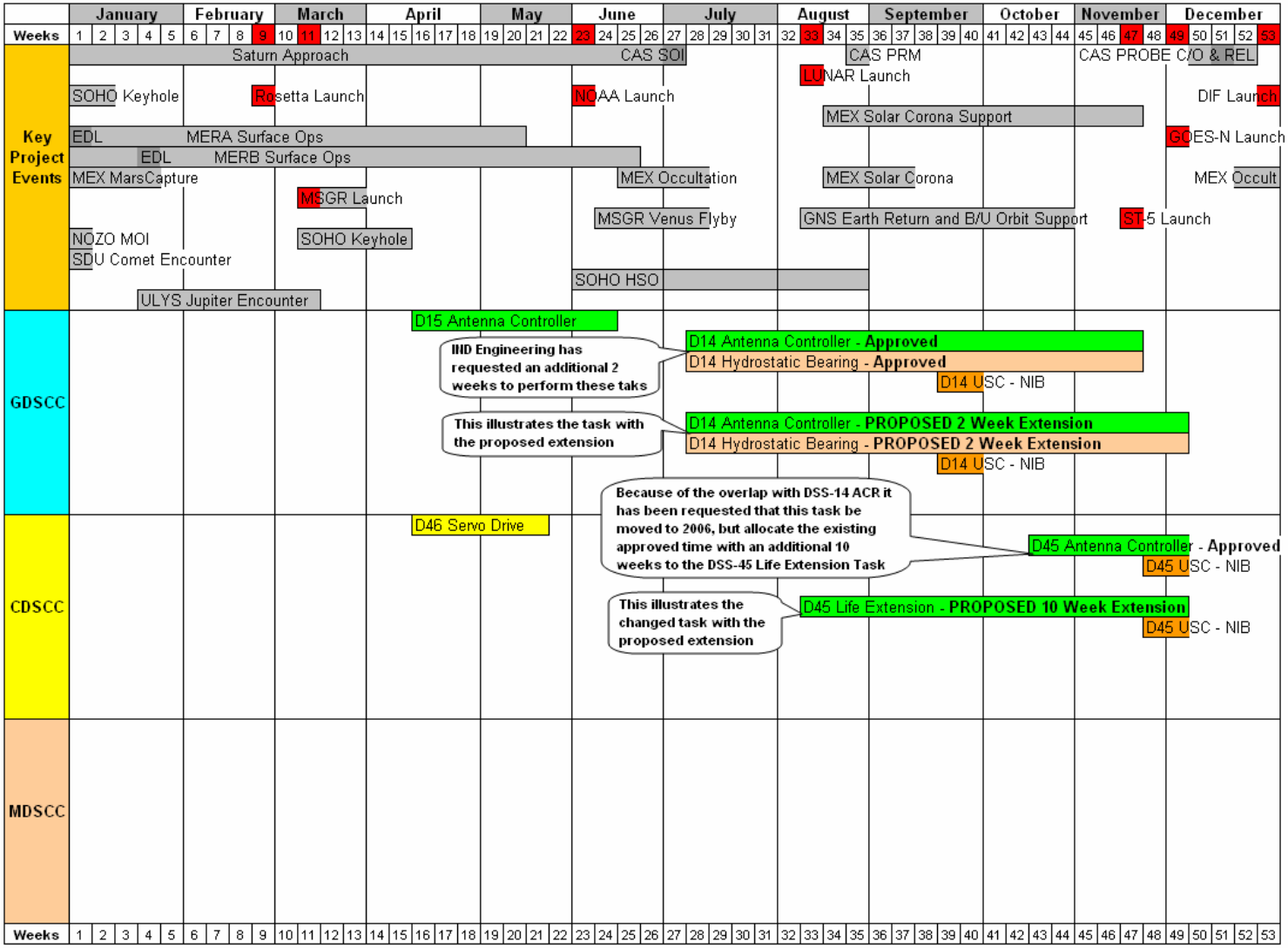
December



MARS=M01O,MEX,MGS,NOZO

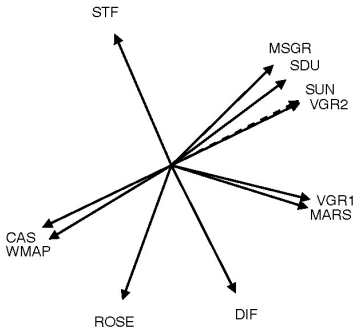
SOHO HGA Keyhole Periods

2004



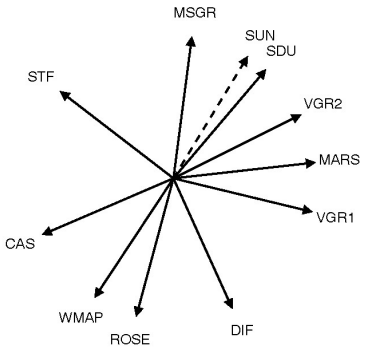
SPACECRAFT RIGHT ASCENSION
2005

January



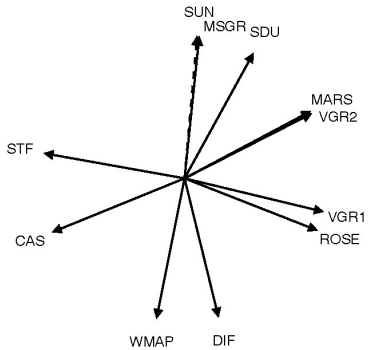
MARS=M01O,MEX,MGS,NOZO

February



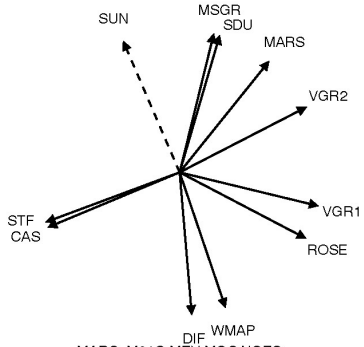
MARS=M01O,MEX,MGS,NOZO

March



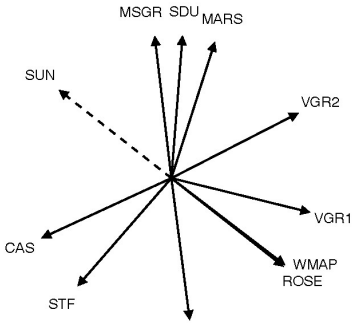
MARS=M01O,MEX,MGS,NOZO

April



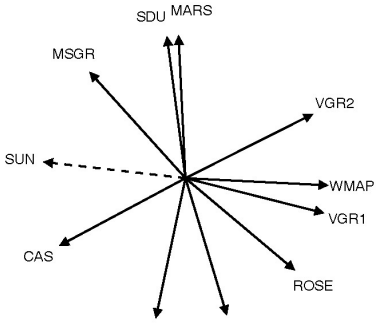
MARS=M01O,MEX,MGS,NOZO

May



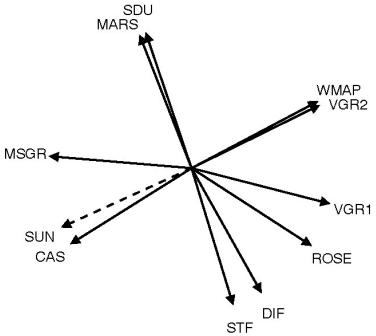
MARS=M01O,MEX,MGS,NOZO

June



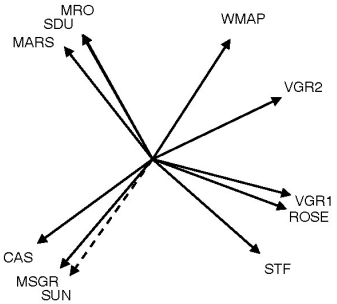
MARS=M01O,MEX,MGS,NOZO

July



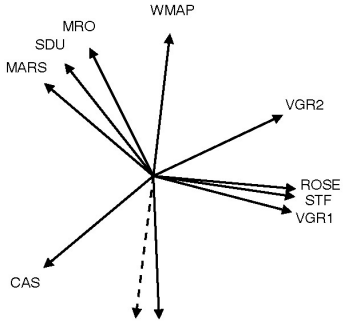
MARS=M01O,MEX,MGS,NOZO

August



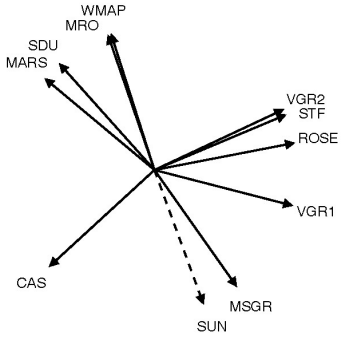
MARS=M01O,MEX,MGS,NOZO

September



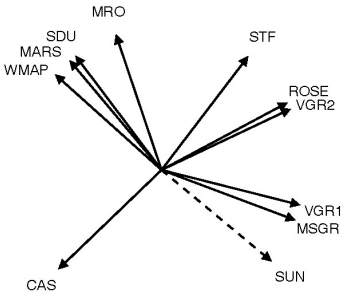
MARS=M01O,MEX,MGS,NOZO

October



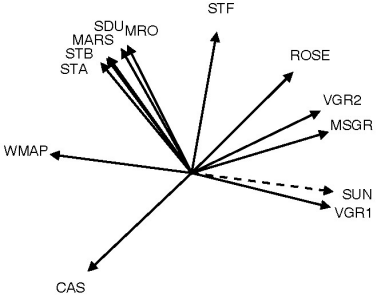
MARS=M01O,MEX,MGS,NOZO

November



MARS=M01O,MEX,MGS,NOZO

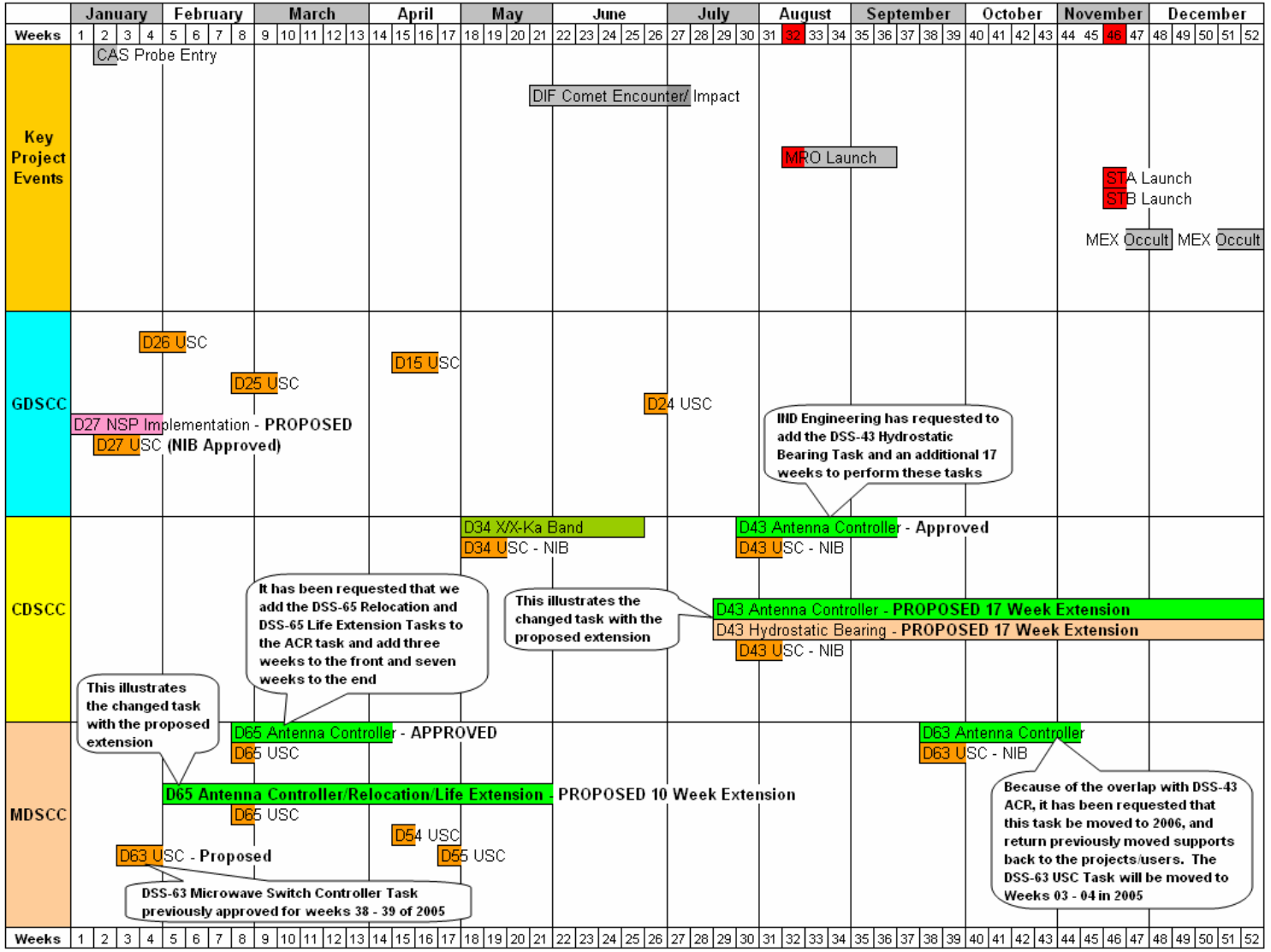
December



MARS=M01O,MEX,MGS,NOZO

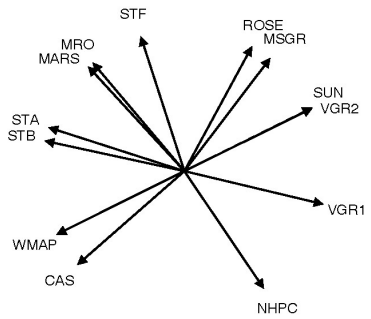
SOHO HGA Keyhole Periods

2005



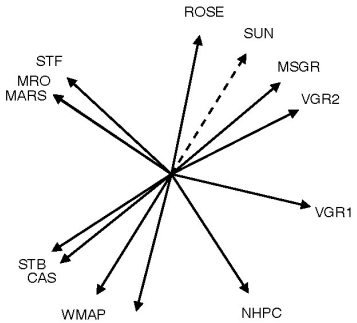
SPACECRAFT RIGHT ASCENSION
2006

January



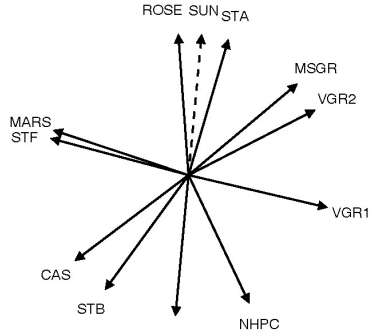
MARS=M01O,MEX,MGS

February



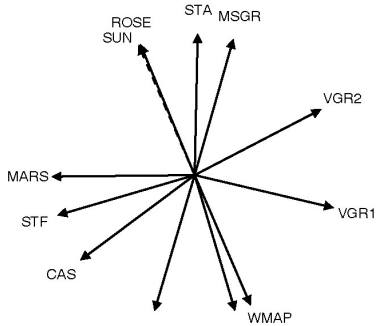
MARS=M01O,MEX,MGS

March



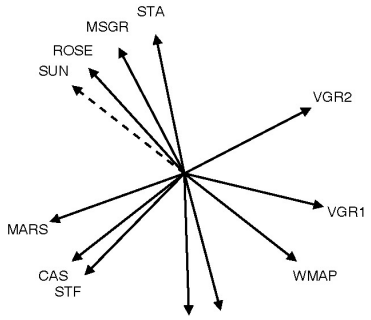
MARS=M01O,MEX,MGS,MRO

April



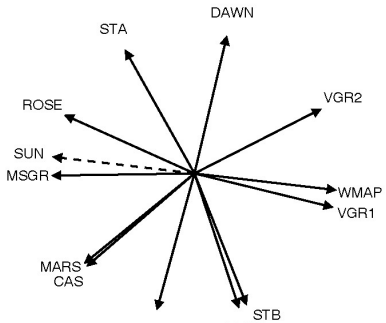
MARS=M01O,MEX,MGS,MRO

May



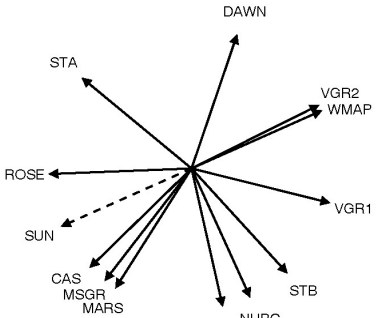
MARS=M01O,MEX,MGS,MRO

June



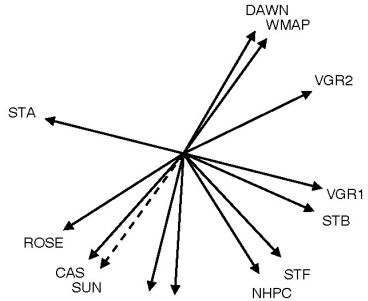
MARS=M01O,MEX,MGS,MRO

July



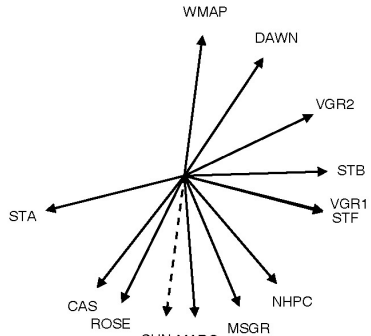
MARS=M01O,MEX,MGS,MRO

August



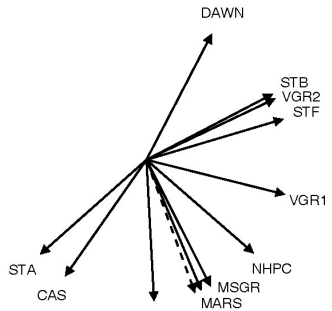
MARS=M01O,MEX,MGS,MRO

September



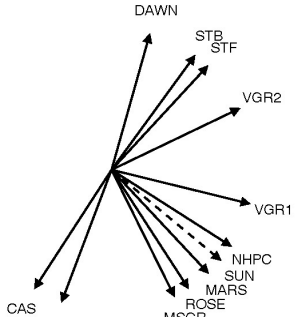
MARS=M01O,MEX,MGS,MRO

October



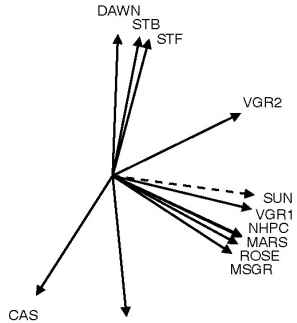
MARS=M01O,MEX,MGS,MRO

November



MARS=M01O,MEX,MGS,MRO

December

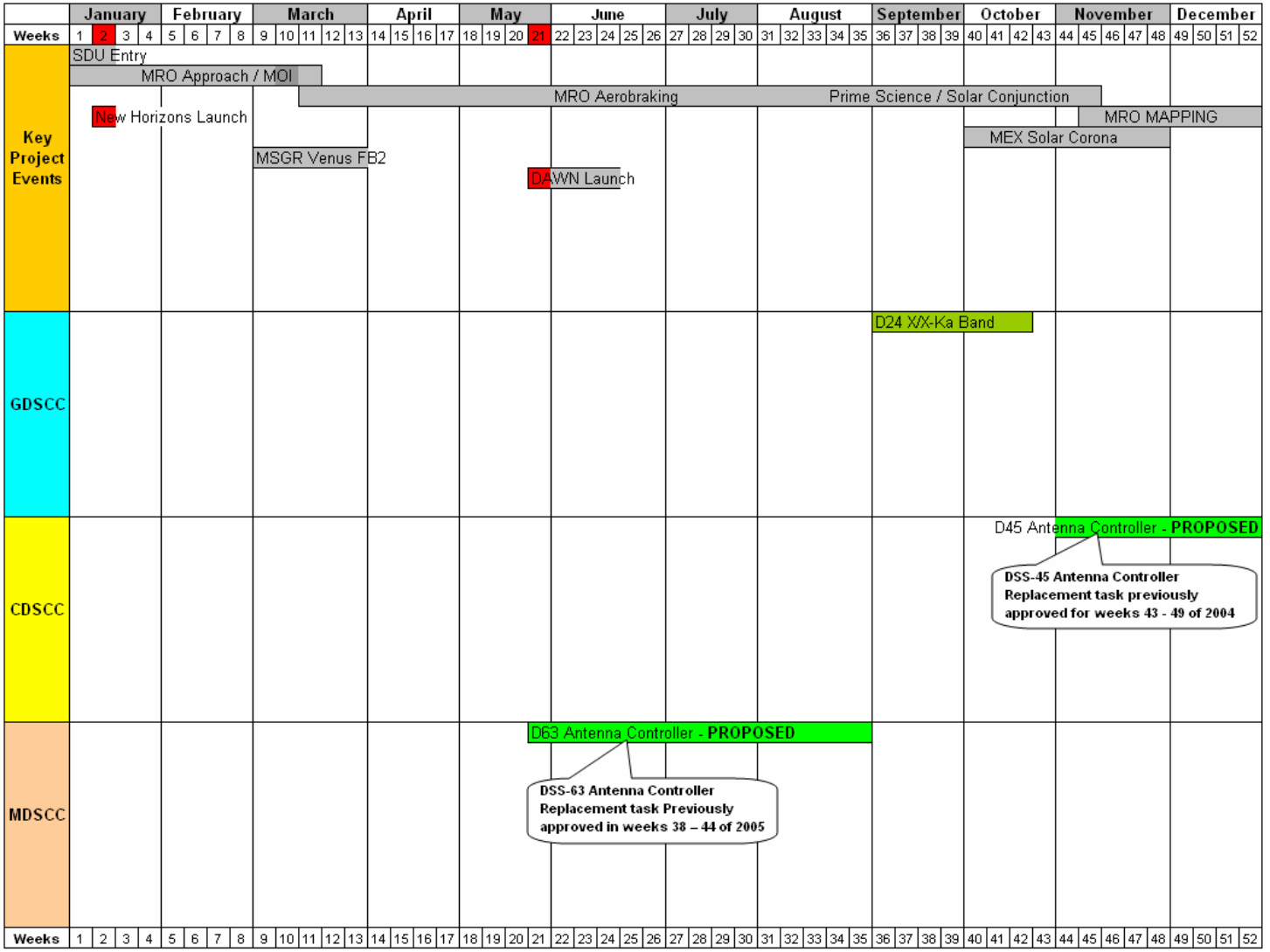


MARS=M01O,MEX,MGS,MRO

Jet Propulsion Laboratory
California Institute of Technology

SOHO HGA Keyhole Periods

2006



SOHO HGA Keyhole Periods Special Study

QUESTIONS REGARDING HGA KEYHOLES